

North Carolina Bicycle Crash Facts
2005-2009

Prepared for
The North Carolina Department of Transportation
Division of Bicycle and Pedestrian Transportation

Prepared by
The University of North Carolina
Highway Safety Research Center

August 2011

Contents

General Trends.....	5
Where NC Bicycle Crashes Occur.....	8
Bicyclist Characteristics.....	12
Bicyclist Age	12
Bicyclist Gender	13
Bicyclist Race	13
Bicyclist Alcohol Use.....	14
Driver and Vehicle Characteristics	15
Driver Age	15
Driver Gender	16
Driver Race.....	16
Driver Injury Severity.....	17
Driver Alcohol Use.....	17
Vehicle Type.....	17
Temporal and Environmental Factors.....	20
Month of Year	20
Day of Week.....	21
Time of Day	22
Light Condition.....	22
Weather.....	23
Roadway Characteristics.....	25
Roadway Type	25
Number of Through Lanes	26
Speed Limit.....	27



General Trends

For the five year period of 2005-2009, a total of 4,824 bicycle-motor vehicle crashes was reported to the North Carolina Division of Motor Vehicles. After falling below 1000 from 1998-99 levels, the number of bicycle crashes trended upwards from 2002 to 2008, topping 1000 again in both 2007 and 2008 (Figure 1). This rise was mostly reflected by an increase in urban area crashes. From 2008 to 2009, reported bicycle collisions dropped by 20%, from 1042 to 829. We, unfortunately, lack exposure data that might help to explain the drop in reported crashes.

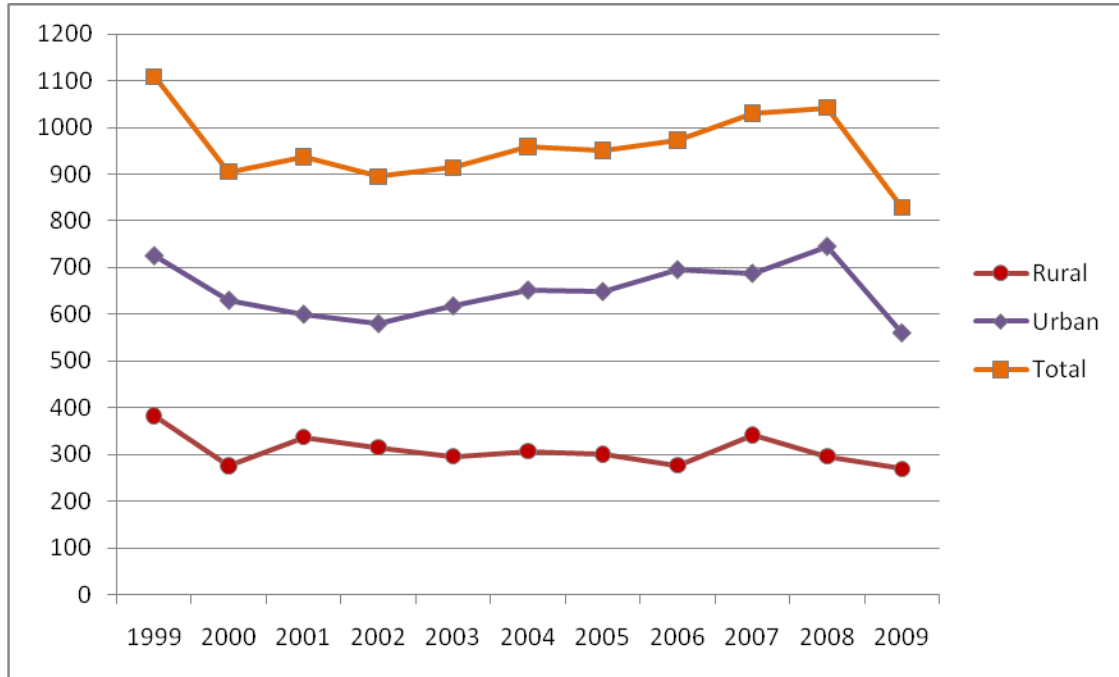


Figure 1. NC bicycle crash trends, 1999 – 2009 (counts of crashes).

The amount of riding by bicyclists would have the greatest impact on collision rates involving bicyclists, and we lack data on amounts of riding by cyclists in NC to compare between years. In comparison, there was proportionally a much smaller drop of 5% in pedestrian collisions since 2007, suggesting that bicycle collisions may be more subject to year-to-year variations such as weather that *may* affect the amount of riding. Another risk factor would be motor vehicle traffic volumes. Annual NC Vehicle Miles Traveled was estimated to increase between 2008 and 2009, especially in the larger urban areas where most bicycle crashes occur, so a reduction in driving would not seem to explain the drop in bicycle crashes.¹ There were also concerns by State officials that the reporting of crashes for 2009 was not as complete compared to prior years, so a combination of amounts of riding, reporting changes, and other factors – possibly including safety improvements, but also

¹ Statewide, annual Vehicle Miles Traveled increased by 1.1% from 101.5 billion, to 102.6 billion from 2008 to 2009.

including chance – could explain the decrease in reported bicycle collisions. Caution is advised in interpreting the one-year improvement, but hopefully this will be the start of a new trend that includes both increases in riding and decreasing numbers of crashes.

A little more than half of bicycle crashes, approximately 55% of the collisions from 2005 to 2009, occurred within the counties in the Piedmont region with numbers trending upwards until 2008, about 38% in the Coastal Plain counties, and the remaining 7.5% in the Mountain region of the State (Figure 2.)

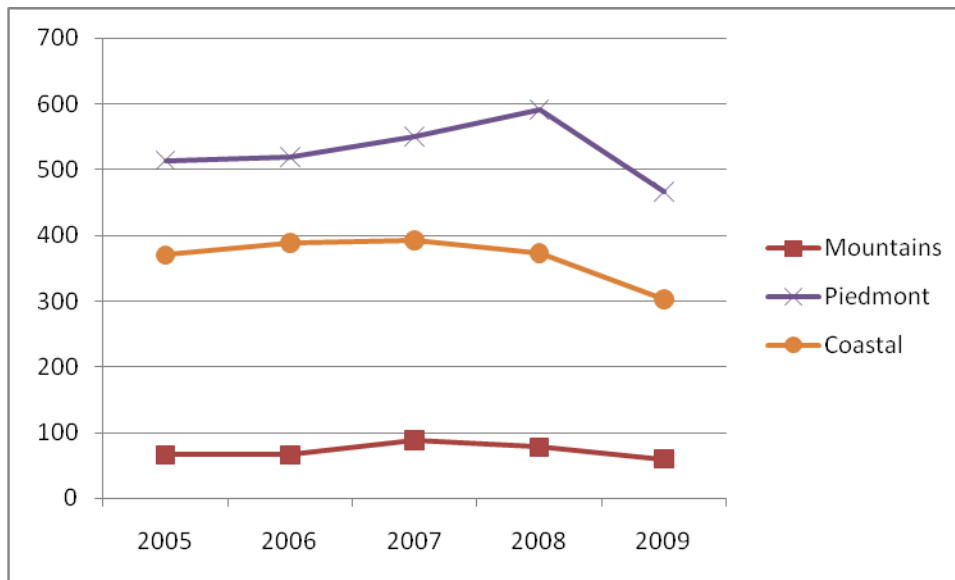


Figure 2. Five-year bicycle crash trends by region of NC.

There were a total of 114 fatal bicyclist crashes over this time period. On average, 23 bicyclists were killed with another 830 being injured or possibly injured each year (Figure 3).

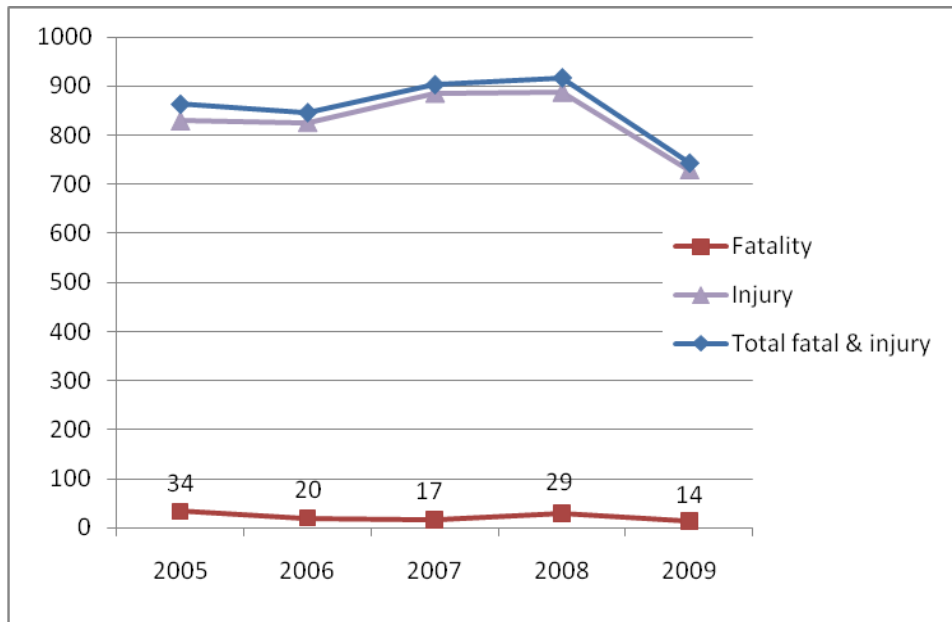


Figure 3. Five-year bicycle crash injury level trends. (Counts are of crashes, with injury level of the first bicyclist in each crash. The totals reflected do not include crashes where no injuries were reported or injury level was unknown.)

The remainder of this report summarizes the location types, person, time, environmental and roadway characteristics for the 4,824 bicycle-motor vehicle crashes that were reported statewide for 2005 - 2009. This information, and similar information developed for local communities, can aid in the targeting of resources and countermeasures to address bicycle safety problems. Descriptions of the types of crashes, or events leading up to the crash, are provided in the companion Bicycle Crash Types Summary report.

These data may include non-injury collisions with less than \$1000 property damage which were not officially “reportable” but had been reported to the State Division of Motor Vehicles. Non-reportable collisions would not be included in other State crash statistics. However, many bicycle crashes go unreported each year, including bike-only crashes on roadways, numerous off-roadway crashes, as well as bicycle-pedestrian and some bicycle-motor vehicle crashes that occur on public roads. These unreported crashes can also result in serious injury, requiring treatment at a hospital or doctor’s office.

As with all crash data, the reported numbers in the crash characteristics that follow undoubtedly reflect some error, including errors or gaps in reporting, as well as errors made during data entry and coding.

Where NC Bicycle Crashes Occur

As shown in figure 1, more than two-thirds (69%) of NC bicycle collisions over the past five years occurred in municipal (urban) limits, with about 31% in unincorporated areas of the State (designated as rural, although some of these areas could be built up). These data are coded based on whether the crash was indicated as occurring within municipal boundaries (urban), or not (rural), and may not reflect area land use.

When looking at development density, as coded by the reporting enforcement agencies, the picture becomes even more weighted toward bicycle crashes occurring in at least somewhat developed areas, with 84% occurring in areas that are at least 30 percent developed, and only 16% indicated to occur in areas that are less than 30% developed (Table 1).

The areas that are between 30 and 70% developed may represent areas in transition and challenging areas to ride, where infrastructure is often still more rural in nature and traffic speeds remain high, while traffic volumes and roadway complexity are increasing. Over the past five years, there has been an increasing trend in the proportion (and at least until 2009), and the number of crashes occurring in such areas.

Table 1. NC bicycle-motor vehicle crashes by area development extent.

Development extent:	2005	2006	2007	2008	2009	Total
Rural (<30% Developed)	167	158	157	158	144	784
	17.6 ¹	16.2	15.2	15.2	17.4	16.3 ²
Mixed (30% To 70% Developed)	137	127	152	161	131	708
	14.4	13.1	14.8	15.5	15.8	14.7
Urban (>70% Developed)	646	688	721	723	554	3332
	68	70.7	70	69.4	66.8	69.1
Total	950	973	1030	1042	829	4824
	19.7 ³	20.2	21.4	21.6	17.2	100

¹ Row percent of column total

² Column percent of row total

³ Column total percent of total

Reflecting the information on development extent, 44% of crashes occurred in areas indicated as residential in nature, 41% in commercial districts, 13% in areas designated as farms, woods, or pasture, and very small percentages in institutional (2%) and industrial areas (0.2%) (Table 2).

Table 2. NC bicycle-motor vehicle crashes by crash area by development type.

Development type:	2005	2006	2007	2008	2009	Total
Farms, Woods, Pastures	125	124	130	120	126	625
	13.2 ¹	12.7	12.6	11.5	15.2	13 ²
Residential	438	428	467	426	363	2122
	46.1	44	45.3	40.9	43.8	44
Commercial	373	398	414	465	317	1967
	39.3	40.9	40.2	44.6	38.2	40.8
Institutional	13	21	16	30	21	101
	1.4	2.2	1.6	2.9	2.5	2.1
Industrial	1	2	3	1	2	9
	0.1	0.2	0.3	0.1	0.2	0.2
Total	950	973	1030	1042	829	4824
	19.7 ³	20.2	21.4	21.6	17.2	100

¹ Row percent of column total² Column percent of row total³ Column total percent of total

Using 2008 population estimates as a rate denominator, the yearly bicycle crash rate averages 1.4 per 10,000 population across all urban areas, and 0.6 per 10,000 population in un-incorporated (more rural) areas of the State for the most recent five-year time period.² The difference between rural and urban crash rates likely reflects greater concentration of destinations in urban areas providing greater opportunities for bicycling, such as commuting and utilitarian trips, than in rural areas of the state.

The ten counties with the highest numbers of bicycle-motor vehicle crashes for the recent five-year period are shown in Table 3. The ten highest crash counties accounted for nearly 55% of NC's reported bicycle-motor vehicle crashes. Most of the counties are highly urbanized. Thus, the high crash counties are, to a large extent, reflections of where people live in the State. However, the crash rates based on population do vary among the high crash frequency counties from a low of 0.7 per 10,000 residents (Forsyth Co.) to a high of 2.6 per 10,000 (New Hanover). The average is 1.3 / 10,000 residents. The county-level rates may reflect differences in amounts of cycling in the counties in addition to other exposure and risk factors.

² 2008 statewide population was estimated (September 17, 2009 update) at 5,099,708 municipal and 4,127,308 for unincorporated areas. Population estimates are from the Office of State Budget and Management, Municipal and Non-Municipal Population by County, retrieved from http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic_data/population_estimates/demog/ctotm08.htm

Table 3. The ten NC counties with the highest numbers of bicycle crashes from 2005-2009. (Crashes for all counties may be obtained through the crash data query tool.)

County	5-Year Count	Percent of NC Total (4824)	2008 County Population est.	Average Yearly Crash Rate/10,000 Residents
Mecklenburg	584	12.1	877,007	1.33
Wake	568	11.8	864,429	1.31
Guilford	278	5.8	468,344	1.19
New Hanover	253	5.2	192,235	2.63
Cumberland	206	4.3	316,914	1.30
Durham	193	4	260,420	1.48
Orange	130	2.7	129,296	2.01
Buncombe	121	2.5	227,875	1.06
Robeson	116	2.4	130,316	1.78
Gaston	113	2.3	204,971	1.10
Forsyth	111	2.3	343,704	0.65
Total - 10 counties	2673	55.4	4,015,511	1.33

Reflecting the high crash counties, a majority of the cities with the highest crash frequencies are the most populous cities in those counties (Table 4). These 10 cities accounted for about 40% of the State's reported bicycle crashes. The crash rates based on population averaged 1.8 per 10,000 residents, which is somewhat higher than the average of 1.4 per 10,000 for municipalities across the entire State. These cities may reflect differences in amounts of bicycling as well as other risk factors. Lower rates of auto ownership, factors such as presence of colleges and universities, or a strong cycling culture, may foster more widespread use of bicycles in some communities than others. However, there are no data to directly compare crash rates based on miles of bicycling, numbers of cycling trips, or other better measures of exposure.

Table 4. The ten NC cities with the highest numbers of bicycle collisions, 2005-2009.

Municipality	2005-09 Count	Percent of NC Total (4824)	2008 City Population est.	Average yearly Crash Rate/10,000 Residents
Charlotte	531	11	683,541	1.55
Raleigh	386	8	377,353	2.05
Durham	179	3.7	228,480	1.57
Wilmington	175	3.6	101,526	3.45
Greensboro	171	3.5	263,268	1.30
Fayetteville	148	3.1	181,481	1.63
Rocky Mount	121	2.5	59,228	4.09
Asheville	89	1.8	78,313	2.27
Chapel Hill	79	1.6	55,616	2.84
Cary	76	1.6	141,167	1.08
Total 10 cities	1955	40.4	2,169,973	1.80

The crash fact descriptions that follow are also undoubtedly related to exposure, or when and where people choose to ride, and who is riding (age, attitudes, skill and physical condition). Crash numbers can also change over time simply due to chance, changes in crash reporting procedures, weather, or other factors such as economics that affect the amounts of cycling and driving, and also as a result of safety-related factors including engineering, educational, and enforcement initiatives.

Bicyclist Characteristics

Bicyclist Age

There is year-to-year variability in the crash involvement by age groups of bicyclists across the five years of data but also seem to be clear trends (Table 5. Note that age group intervals vary to show more detail for the younger age groups.) Overall, the largest proportion of crashes involved ages 11-15 years (nearly 16%), although the involvement of this group continues to decline, from 18% in 2005 to 13% in 2009. Children less than 16 years old on average accounted for 26% of all the crashes, but again, crash involvement by children continues a general downward trend. Teens and young adults of college age (16 to 20 and 21 to 25-year groups), were also highly represented, together accounting for another 23%, with the 21 to 25 year group showing increasing crash trends. Those aged 41 – 50 and 51 to 60 have also shown increases in crash involvement over this period. Among adults, only the 31 to 40 year, and 71 and over age groups saw numerical and proportional decreases in their crash involvement over this time period. NC seems to be following national trends, with middle to older adult ages showing higher crash involvement over recent years, perhaps reflecting increasing age of the population as well as more riding by these age groups.

Table 5. Bicyclist age group of those involved in crashes.

Ages	2005	2006	2007	2008	2009	Total
0-5	19	12	15	13	5	64
	2 ¹	1.2	1.5	1.3	0.6	1.3
6-10	94	88	109	71	64	426
	9.9	9	10.6	6.9	7.7	8.9
11-15	175	158	167	154	108	762
	18.4	16.2	16.2	15	13.1	15.8
16-20	121	135	150	143	115	664
	12.7	13.9	14.6	13.9	13.9	13.8
21-25	82	91	74	92	104	443
	8.6	9.4	7.2	8.9	12.6	9.2
26-30	50	64	52	81	67	314
	5.3	6.6	5	7.9	8.1	6.5
31-40	131	118	136	120	77	582
	13.8	12.1	13.2	11.7	9.3	12.1
41-50	147	165	158	179	157	806
	15.5	17	15.3	17.4	19	16.8
51-60	72	85	106	117	95	475
	7.6	8.7	10.3	11.4	11.5	9.9
61-70	27	20	23	50	26	146
	2.8	2.1	2.2	4.9	3.1	3
71+	32	37	40	10	8	127
	3.4	3.8	3.9	1	1	2.6
Total	950	973	1030	1030	826	4809 ³
	19.8 ²	20.2	21.4	21.4	17.2	100

¹ Row percent of column total

² Column percent of row total

³ Total includes the first bicyclist in crash less any cases with missing data.

Bicyclist Gender

There is relatively little change year-to-year, with male bicyclists accounting for about 85% of the crash-involved bicyclists in NC (Table 6).

Table 6. Bicyclist gender of those involved in crashes.

Gender	2005	2006	2007	2008	2009	Total
Female	138 ¹	144	148	157	116	703
	14.8	15.1	14.7	15.2	14.1	14.8
Male	795	811	857	878	708	4049
	85.2	84.9	85.3	84.8	85.9	85.2
Total	933	955	1005	1035	824	4752 ³
	19.6 ²	20.1	21.1	21.8	17.3	100

¹Row percent of column total

²Column percent of row total

³Total includes the first bicyclist in crash less any cases with missing data.

Bicyclist Race

Black bicyclists accounted for 39% on average over this time period, with a marked decrease in crash involvement in 2008 and 2009. White bicyclists comprised about 52% over the time period, with the proportion increasing over the five years (Table 7). Bicyclists identified as Hispanic account for about 5%, Native American for about 1.5%, and Asians for 1% or less on average.

Table 7. Bicyclist race/ethnicity.

Race / ethnicity	2004	2005	2006	2007	2008	Total
Asian	6	9	9	10	6	40
	0.6 ¹	1	0.9	1	0.7	0.8
Black	407	402	402	373	277	1861
	44	42.4	40.2	36.2	33.9	39.4
Hispanic	48	49	55	57	34	243
	5.2	5.2	5.5	5.5	4.2	5.1
Native American	14	16	14	17	9	70
	1.5	1.7	1.4	1.6	1.1	1.5
Other	3	3	7	9	10	32
	0.3	0.3	0.7	0.9	1.2	0.7
White	446	468	513	565	482	2474
	48.3	49.4	51.3	54.8	58.9	52.4
Total	924	947	1000	1031	818	4720 ³
	19.6 ²	20.1	21.2	21.8	17.3	100

¹Row percent of column total

²Column percent of row total

³Total includes the first bicyclist in crash less any cases with missing data.

Bicyclist Alcohol Use

According to the information available on police crash reports, alcohol use by bicyclists was detected or suspected in about 8% of all bicyclists involved in crashes from 2005-2009 (Table 8).

Table 8. Bicyclist use of alcohol.

Bicyclist Alcohol Use suspected/detected	2005	2006	2007	2008	2009	Total
No	858	883	944	950	773	4408
	91.2 ¹	91.6	93.1	91.4	93.2	92.1
Yes	83	81	70	89	56	379
	8.8	8.4	6.9	8.6	6.8	7.9
Total	941	964	1014	1039	829	4787 ³
	19.7 ²	20.1	21.2	21.7	17.3	100

¹Row percent of column total

²Column percent of row total

³Total includes the first bicyclist in crash less any cases with missing data

Driver and Vehicle Characteristics

Driver Age

On average, drivers age 24 and younger accounted for 22% of all collisions with bicyclists with drivers between 25 and 29 accounting for another 11% (Table 9. Note that again age intervals vary). Among 10-year+ age groups, the largest proportion of crashes involved the 30-39 year old group of drivers (19%), closely followed by the 40-49 year old group (18%) with proportions decreasing with increasing age of groups 50 and up.

Table 9. Ages of drivers involved in crashes with bicyclists.

Driver Age	2005	2006	2007	2008	2009	Total
0-19	61	78	71	68	50	328
	7.2 ¹	9.1	8.0	7.4	7.0	7.8
20-24	121	106	116	131	107	581
	14.2	12.3	13.0	14.3	15.0	13.7
25-29	93	101	90	103	73	460
	10.9	11.7	10.1	11.3	10.3	10.9
30-39	166	153	159	170	137	785
	19.5	17.8	17.8	18.6	19.2	18.6
40-49	163	164	151	169	110	757
	19.1	19.1	16.9	18.5	15.4	17.9
50-59	125	118	146	130	96	615
	14.7	13.7	16.4	14.2	13.5	14.5
60-69	61	85	89	77	71	383
	7.2	9.9	10.0	8.4	10.0	9.1
70+	63	55	69	65	68	320
	7.4	6.4	7.7	7.1	9.6	7.6
Total	853	860	891	913	712	4229 ³
	20.2 ²	20.3	21.1	21.6	16.8	100

¹Row percent of column total

²Column percent of row total

³Total includes the first driver per crash less missing data including for hit and run drivers.

Driver Gender

Male drivers accounted for 54% of the bicycle-motor vehicle crashes and female drivers 46% over this period (Table 10). Although there are year-to-year fluctuations, no obvious trend is apparent.

Table 10. Gender of drivers involved in NC collisions with bicyclists.

Driver Gender	2005	2006	2007	2008	2009	Total
Male	447	460	490	489	401	2287
	52.5 ¹	53.6	55	53.7	56.3	54.1
Female	405	398	401	422	311	1937
	47.5	46.4	45	46.3	43.7	45.9
Total	852	858	891	911	712	4224 ³
	20.2 ²	20.3	21.1	21.6	16.9	100

¹Row percent of column total

²Column percent of row total

³Total includes the first driver per crash less missing data including for hit and run drivers.

Driver Race

White drivers were involved in 62% and Black drivers 31% of the crashes with bicyclists on average (Table 11). Identified Hispanics accounted for about 4% of the 2005-2009 crash-involved drivers, Native Americans for about 1.5%, and Asians account for around 1% in each of those years on average.

Table 11. Race/ethnicity of drivers involved in crashes with bicyclists.

Driver Race	2005	2006	2007	2008	2009	Total
Asian	9	5	14	7	8	43
	1.1 ¹	0.6	1.6	0.8	1.1	1
Black	267	272	273	279	221	1312
	31.4	31.9	30.9	30.7	31.2	31.2
Hispanic	35	37	28	33	16	149
	4.1	4.3	3.2	3.6	2.3	3.5
Native American	15	15	14	9	8	61
	1.8	1.8	1.6	1	1.1	1.5
Other	10	8	6	11	5	40
	1.2	0.9	0.7	1.2	0.7	1
White	514	517	549	569	451	2600
	60.5	60.5	62.1	62.7	63.6	61.8
Total	850	854	884	908	709	4205 ³
	20.2 ²	20.3	21	21.6	16.9	100

¹Row percent of column total

²Column percent of row total

³Total includes the first driver per crash less missing data including for hit and run drivers.

Driver Injury Severity

As would be expected, drivers are rarely seriously injured in crashes with bicyclists. Approximately 97% received no injuries from 2005-2009, and about 3% were reported to receive possible or evident injuries (data not shown). There was a fatal injury involving a driver in 2008 and two driver disabling injuries reported for both 2007 and 2008.

Driver Alcohol Use

Alcohol use by drivers in crashes with bicyclists was detected or suspected in 2% of crashes (Table 12). This indication does not confirm impairment or that alcohol was a factor in the crash.

Table 12. Alcohol use suspected for drivers involved in crashes with bicyclists.

Driver Alcohol Use Suspected/Detected	2005	2006	2007	2008	2009	Total
No	852	855	888	911	719	4225
	98.3 ¹	98.4	97.9	97.6	98.1	98.1
Yes	15	14	19	22	14	84
	1.7	1.6	2.1	2.4	1.9	1.9
Total	867	869	907	933	733	4309 ³
	20.1 ²	20.2	21	21.7	17	100

¹ Row percent of column total

² Column percent of row total

³ Total includes the first driver per crash less missing data including for hit and run drivers.

Vehicle Type

Most vehicles involved in crashes with bicyclists were passenger vehicles, including cars, pickups, light trucks and mini vans, sport utility vehicles (SUVs), and vans, which together accounted for about 96% of collisions with bicyclists (

Table 13). While passenger cars accounted for the majority (59%), SUVs accounted for about 15%, and pickups for 14%. Vans and light trucks and mini-vans accounted for 8% of collisions.

School and activity buses were involved in 19 collisions with bicyclists over this time period and commercial buses in 11. Other heavy vehicles, including all types of large trucks, accounted for 71 collisions, or less than 2% of the total, but heavy vehicles, including buses contribute to severe injuries and thus are a concern. Emergency vehicles, including 21 police cars, accounted for another ½ of one percent of the collisions with bicyclists.

Table 13. Vehicle types involved in crashes with bicyclists.

Driver Vehicle Type	2005	2006	2007	2008	2009	Total
Passenger Car	523	501	552	560	427	2563
	60.3 ¹	56.6	59.9	58.3	57.1	58.5
Pickup	109	137	140	125	107	618
	12.6	15.5	15.2	13	14.3	14.1
Light Truck (Mini-Van, Panel)	27	18	13	24	15	97
	3.1	2	1.4	2.5	2	2.2
Sport Utility	119	125	132	148	123	647
	13.7	14.1	14.3	15.4	16.4	14.8
Van	53	59	52	46	48	258
	6.1	6.7	5.6	4.8	6.4	5.9
Commercial Bus	5	1	1	2	2	11
	0.6	0.1	0.1	0.2	0.3	0.3
School Bus	7	3	2	4	2	18
	0.8	0.3	0.2	0.4	0.3	0.4
Activity Bus	0	0	1	0	0	1
	0	0	0.1	0	0	0
Other Bus	0	0	1	0	1	2
	0	0	0.1	0	0.1	0
Single Unit Truck (2-Axle, 6-Tire)	5	8	8	10	2	33
	0.6	0.9	0.9	1	0.3	0.8
Single Unit Truck (3 Or More Axles)	3	3	1	1	0	8
	0.3	0.3	0.1	0.1	0	0.2
Truck/Trailer	1	1	4	2	1	9
	0.1	0.1	0.4	0.2	0.1	0.2
Tractor/Semi-Trailer	4	1	4	3	2	14
	0.5	0.1	0.4	0.3	0.3	0.3
Unknown Heavy Truck	1	3	1	2	0	7
	0.1	0.3	0.1	0.2	0	0.2
Taxicab	1	2	2	0	2	7
	0.1	0.2	0.2	0	0.3	0.2
Motorcycle	6	4	1	6	9	26
	0.7	0.5	0.1	0.6	1.2	0.6
Pedalcycle	0	16	0	17	0	33
	0	1.8	0	1.8	0	0.8
Pedestrian	0	1	0	3	2	6
	0	0.1	0	0.3	0.3	0.1
Motor Home/Recreational Vehicle	0	0	1	0	0	1
	0	0	0.1	0	0	0

Driver Vehicle Type	2005	2006	2007	2008	2009	Total
EMS Vehicle, Ambulance, Rescue Squad	2	0	0	0	0	2
	0.2	0	0	0	0	0
Police	1	2	5	8	5	21
	0.1	0.2	0.5	0.8	0.7	0.5
Total	867	885	921	961	748	4382 ³
	19.8 ²	20.2	21	21.9	17.1	100

¹ Row percent of column total

² Column percent of row total

³ Total includes the first vehicle in crash less any cases missing vehicle data (including for unidentified hit and run vehicles).

Temporal and Environmental Factors

Month of Year

There is substantial difference in the proportions of bicycle-motor vehicle crashes as related to month of year. In contrast to pedestrian collisions, more bicycle collisions occur during the summer months, taper off through the fall and winter, and climb again in spring months (Figure 4). There was also year-to-year variability in proportions of crashes by month. This variation could relate in part to the varying periods of warm and cold weather or rainy and clear/cloudy conditions and amounts of riding in any given year, and in part to chance.

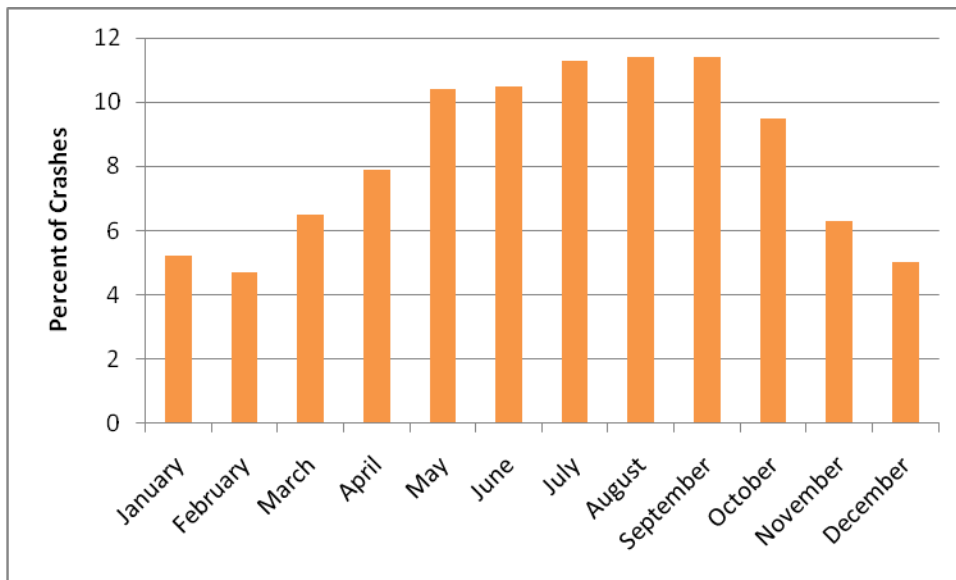


Figure 4. NC bicycle collisions by crash month, 2005-2009.

Day of Week

Bicycle-motor vehicle crashes were fairly equally spread across weekdays with weekend days of Saturday and, particularly, Sunday having fewer crashes (Figure 5). Commuting trips would be lower on weekend days while recreational trips may be higher, but we have no data to verify the volume and types of trips by day, nor how risk factors might differ for different types of trips.

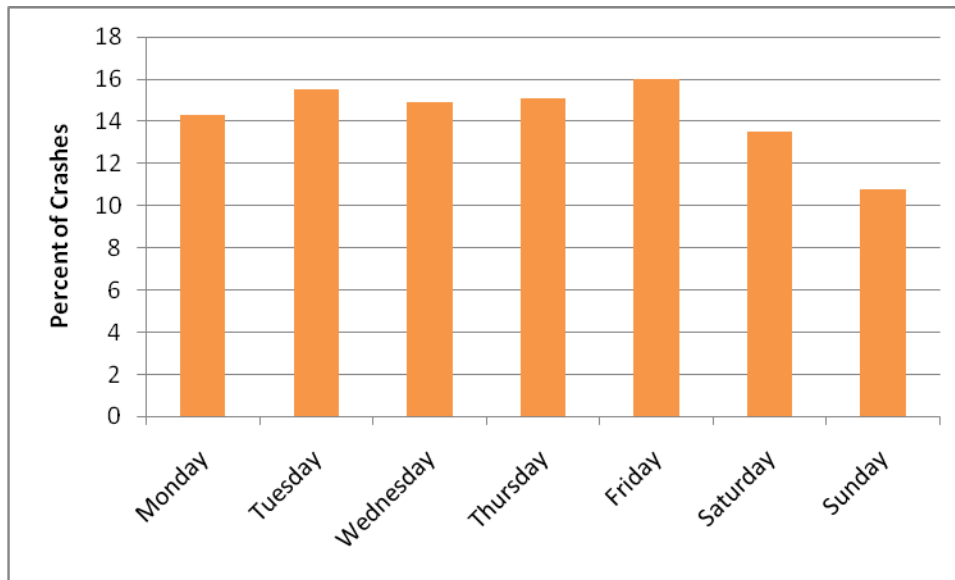


Figure 5. NC bicycle crashes by day of week, 2005-2009.

Time of Day

Most crashes occurred during mid-afternoon to evening hours (Figure 6). About 30% of all crashes occurred between 3 and 6 p.m., peak travel times for commuters, and also a time when children might be riding after school. Another 22% occurred between 6 and 9 p.m. with nearly 9% occurring from 9 p.m. to midnight. Exposure data are lacking to know whether night-time hours are over-represented for crashes. Mid-day periods including noon to 3 p.m. and 9 a.m. to noon accounted for 18% and 10% respectively, with morning commute hours accounting for about 8%.

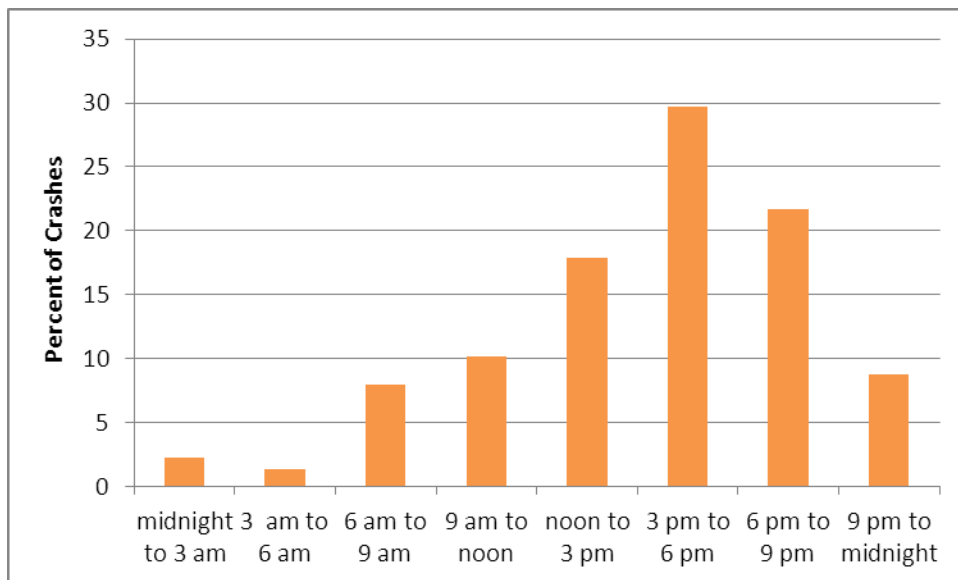


Figure 6. NC bicycle crashes by time of day, 2005-2009.

Light Condition

About three-fourths (73%) of crashes happen in conditions of daylight during the five years (Figure 7). Another 22% occur during conditions of darkness, and in about half of these the roadway was lighted and half, unlighted. Dawn and dusk conditions combined account for about 5% of crashes. There is some variability across years in these percentages, but no distinct trends.

NC State law requires bicyclists operating at night to have an active, white front light visible from at least 300 feet, and a rear, red reflector that is visible from a distance of 200 feet. In addition, active rear, red lights are also available to supplement passive reflectors, and reflective clothing, leg and arm bands, or other reflective gear may further help increase the conspicuity of cyclists riding at night.

Additional roadway lighting could also be considered in unlighted areas where bicyclists frequently ride at night, and at path and roadway intersections.

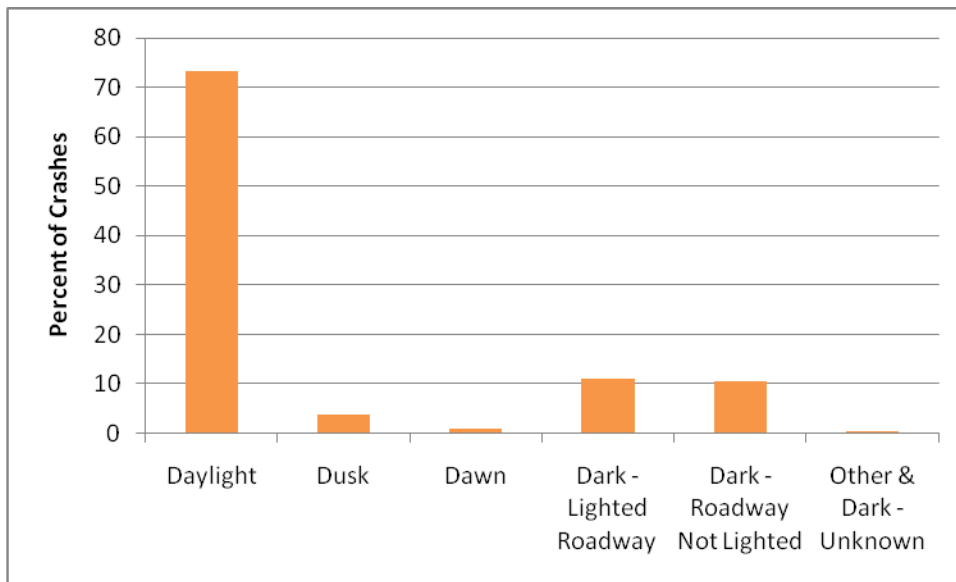


Figure 7. NC Bicycle collisions by light condition, 2005-2009.

Weather

The vast majority of crashes occurred under clear (82%) and cloudy (14%) weather (Table 14). Less than 4% of bicycle-motor vehicle crashes took place under rainy conditions. The variability from year-to-year may reflect the prevalence of different conditions, and also bicyclists' choice of when to ride. Note, for example, that the 2007 increase in crashes is almost entirely reflected in an increase in crashes under clear skies and when the State was undergoing extensive drought conditions, and therefore had more than the usual sunny days.

Table 14. Bicycle crashes by weather conditions.

Weather Condition	2005	2006	2007	2008	2009	Total
Clear	752	796	902	838	671	3959
	79.2 ¹	81.8	87.6	80.4	80.9	82.1
Cloudy	154	145	96	147	122	664
	16.2	14.9	9.3	14.1	14.7	13.8
Rain	40	25	29	48	33	175
	4.2	2.6	2.8	4.6	4	3.6
Snow, Sleet, Hail, Freezing Rain/Drizzle	1	1	0	0	2	4
	0.1	0.1	0	0	0.2	0.1
Fog, Smog, Smoke	3	3	1	6	1	14
	0.3	0.3	0.1	0.6	0.1	0.3
Other	0	3	2	3	0	8
	0	0.3	0.2	0.3	0	0.2
Total	950	973	1030	1042	829	4824
	19.7 ²	20.2	21.4	21.6	17.2	100

¹ Row percent of column total

² Column percent of row total

Reflecting the tendency not to ride during poor weather conditions, only about 8% of collisions took place when road surfaces were wet and virtually none when surfaces were icy, snowy, or muddy (data not shown).

Roadway Characteristics

Roadway Type

About 61% of bicycle-motor vehicle crashes took place on streets indicated to be local streets, although these designations often include higher classification roadways within city limits (Table 15). It is not clear whether the fluctuations observed, such as the jump in crashes from 7% to 12% designated as occurring on NC Routes and the concurrent decline designated as on local streets between 2008 and 2009 reflects changes or improvements in coding, changes in roadway classifications, or actual changes in crash frequencies on these types of roadways.

On average, another 17% occurred on State secondary routes. Seven to 8% each occurred on US and NC routes. About 7% happened in public vehicular areas (typically parking lots). Only a minor number took place on Interstate roadways (where bicycles are not allowed to ride by law).

Table 15. Bicycle crashes by roadway classification.

Road Classification	2005	2006	2007	2008	2009	Total
Interstate	3	1	2	1	1	8
	0.3 ¹	0.1	0.2	0.1	0.1	0.2
US Route	68	68	73	64	69	342
	7.2	7	7.1	6.1	8.4	7.1
NC Route	64	67	80	74	101	386
	6.7	6.9	7.8	7.1	12.2	8
State Secondary Route	167	151	179	165	141	803
	17.6	15.5	17.4	15.8	17.1	16.7
Local Street	587	610	618	652	452	2919
	61.8	62.7	60	62.6	54.7	60.5
Public Vehicular Area	58	67	75	78	51	329
	6.1	6.9	7.3	7.5	6.2	6.8
Private Road, Driveway	3	9	3	8	8	31
	0.3	0.9	0.3	0.8	1	0.6
Unknown	0	0	0	0	3	3
	0	0	0	0	0.4	0.1
Total	950	973	1030	1042	826	4821
	19.7 ²	20.2	21.4	21.6	17.1	100

¹ Row percent of column total

² Column percent of row total

³ Total reflects roadways and vehicular areas with non-missing data

Number of Through Lanes

A majority, 60%, of bicycle-motor vehicle crashes occurred on roads with two through lanes of traffic (Table 16). Sixteen percent were on roads of four lanes, 10% on roads of 5 lanes, and 8% on roads of 3 lanes, with on 2% on one-lane roads. Another 4-5% were on roads of more than 5 through travel lanes.

Table 16. Bicyclist crashes by number of through travel lanes.

Number of Lanes	2005	2006	2007	2008	2009	Total
1	18	20	25	19	16	98
	2 ¹	2.2	2.5	2	2.1	2.2
2	539	543	614	563	469	2728
	60.2	59.9	62.3	58.1	60.1	60.1
3	79	70	74	69	63	355
	8.8	7.7	7.5	7.1	8.1	7.8
4	138	150	161	161	115	725
	15.4	16.5	16.3	16.6	14.7	16
5	81	91	79	98	80	429
	9.1	10	8	10.1	10.3	9.5
More than 5 Lanes	40	33	33	59	37	202
	4.5	3.6	3.3	6.1	4.7	4.5
Total	895	907	986	969	780	4537 ³
	19.7 ²	20	21.7	21.4	17.2	100

¹ Row percent of column total

² Column percent of row total

³ Total reflects roadways and vehicular areas with number of through lanes indications

Reflecting the lane number trends, the vast majority of bicycle-motor vehicle crashes occur on two-way, undivided roadways (77%) with about 4% on one-way roads (data not shown). About 18% occur on two-way roads divided by a median.

Speed Limit

A majority (64%) of NC's bicycle-motor vehicle crashes (that occurred on roadways with posted limits) occurred on roads with speed limits of 35 mph or less, similar to the 69% of crashes that occurred inside city limits (of crashes that occurred on streets with a posted limit). The group of 40 – 45 mph roadways accounted for 22% of crashes, and 50 mph and above posted roadways accounted for 14% (Figure 8). While there is some variability in the crash percentages by year, no obvious trends are evident.

Although crashes on higher-speed roads (40 mph and upwards) are less frequent than those on lower-speed roads, crashes on higher speed roads may be especially severe. Less than 1% of bicyclists struck on NC roads with speed limits of 35 mph and lower were killed, but the proportions killed rose to 3%, 8%, and 38% of those struck on 40 – 45 mph, 50 – 55 mph, and 60 – 75 mph roadways, respectively. In all, 76% of bicyclists killed were struck on roadways of 40 mph limits and higher, the majority on 50 – 55 mph roadways. (Note that we do not have good information on actual travel speeds of the striking vehicles, but the speed limit of the roadway provides some information about the general travel speed.)

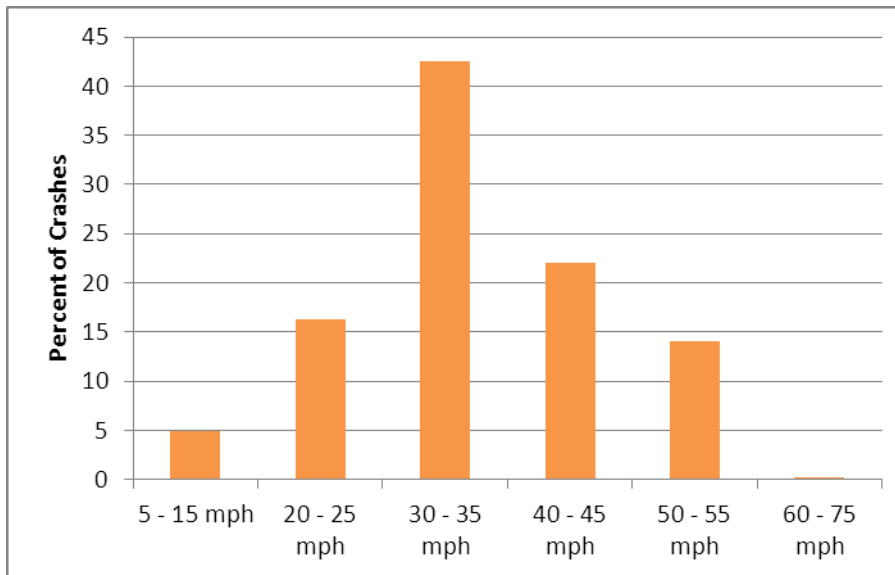


Figure 8. Percentage of NC bicycle crashes for different roadway speed limits, 2005-2009.

For additional information on the types of bicycle-motor vehicle crashes occurring in the State over the same time period, see the **North Carolina Bicycle Crash Types** summary report.